Integrated Watershed Management Plan to Reduce Nitrogen Loading in the Oyster River Watershed

NHDES Drinking Water Conference
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Regulatory Permit Drivers

- WWTF Permit Expired in 2004
- EPA - Limit of Technology Effluent Limit of 3 mg/L
- Requires Higher Capital and O&M Costs
- Durham and UNH Subject to MS4 Stormwater Permit Expired in 2008.
- Adjoining Urbanized Areas

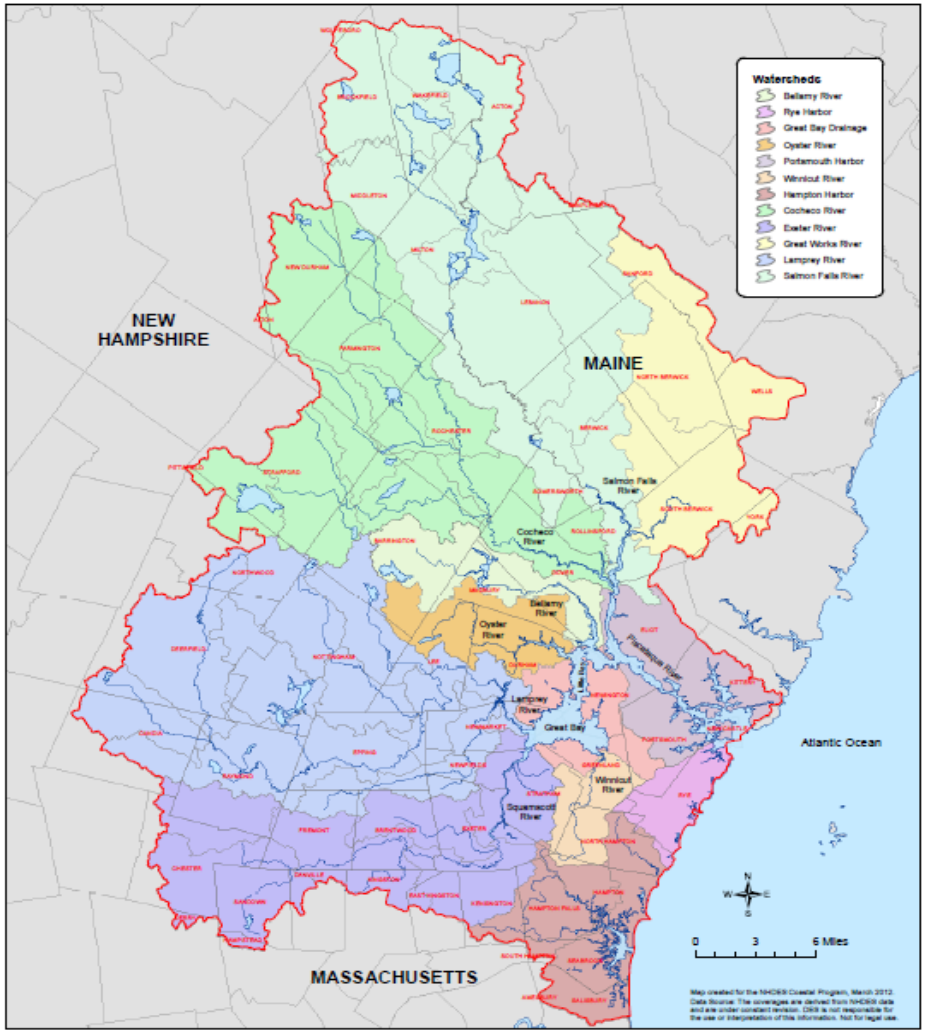
Compliance Options for EPA Discharge Permits

Two Options:

1. Independently Comply with WWTF Permit and MS4 Stormwater Permits.
2. Balance WWTF & MS4 Compliance Requirements & Nonpoint Source Control Measures through an Integrated Watershed Plan.

Durham-UNH Case Study

Coastal Watershed



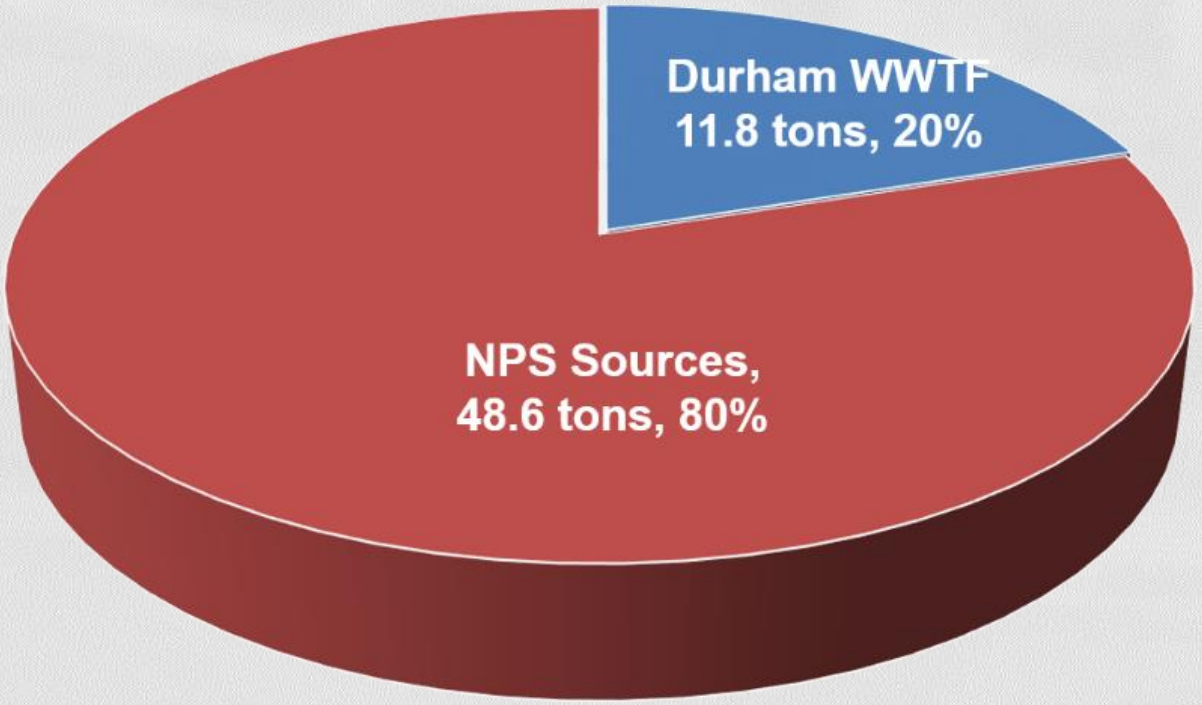
Benefits of Integrated Permitting

- ✓ Opportunity for Cost Savings
- ✓ Incentive to Address Nonpoint Sources through Water Quality Trading
- ✓ Promotes Innovation to Identify all Options
- ✓ Increased Stakeholder Involvement & Equity to Improve Water Quality
- ✓ Enables Holistic Watershed Solutions and Benefits (not just sewered or MS4 areas)

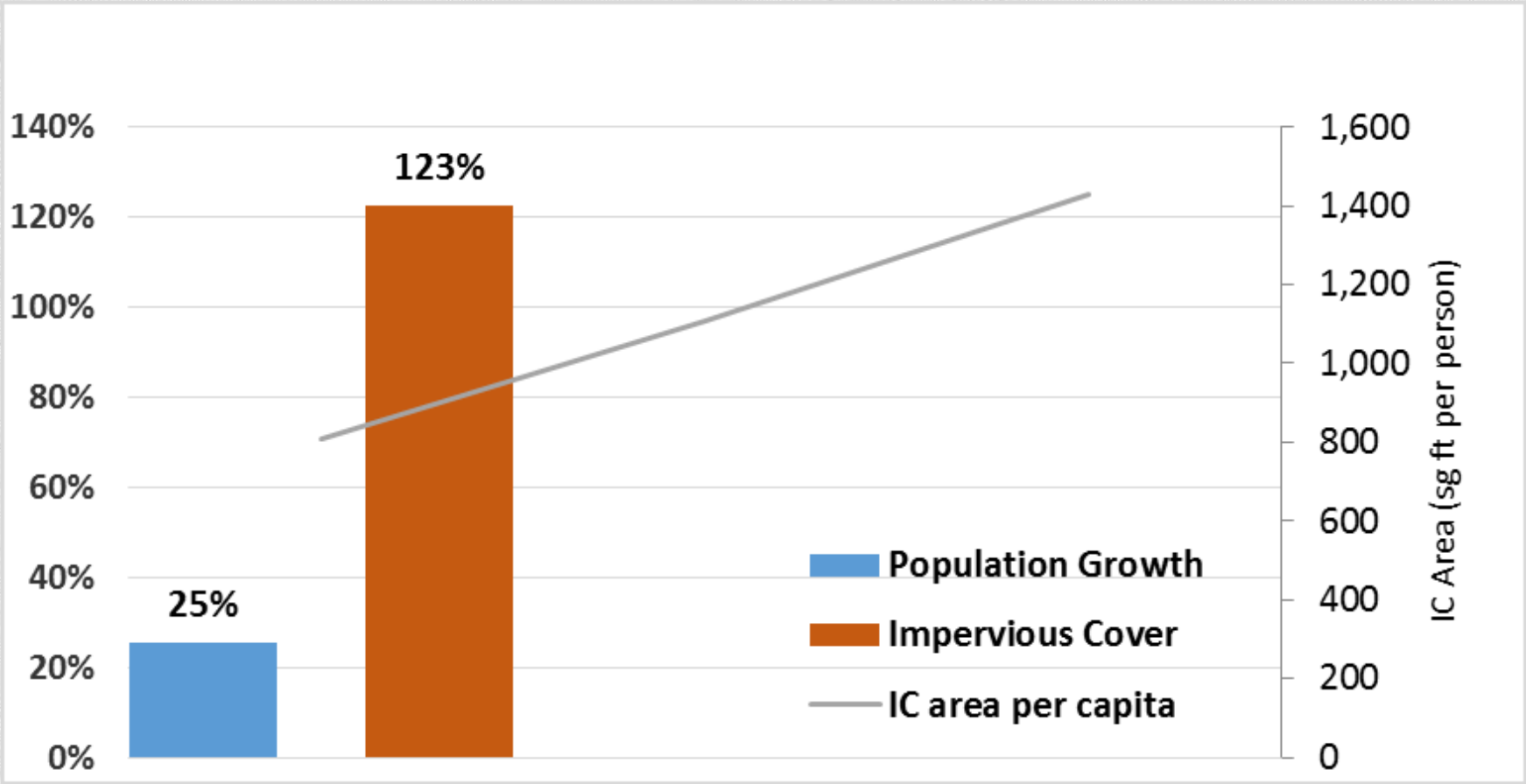
Economic-Environmental-Social

triple bottom line approach

Nonpoint Sources Contribute Much Higher Percentage of Nutrient Loads



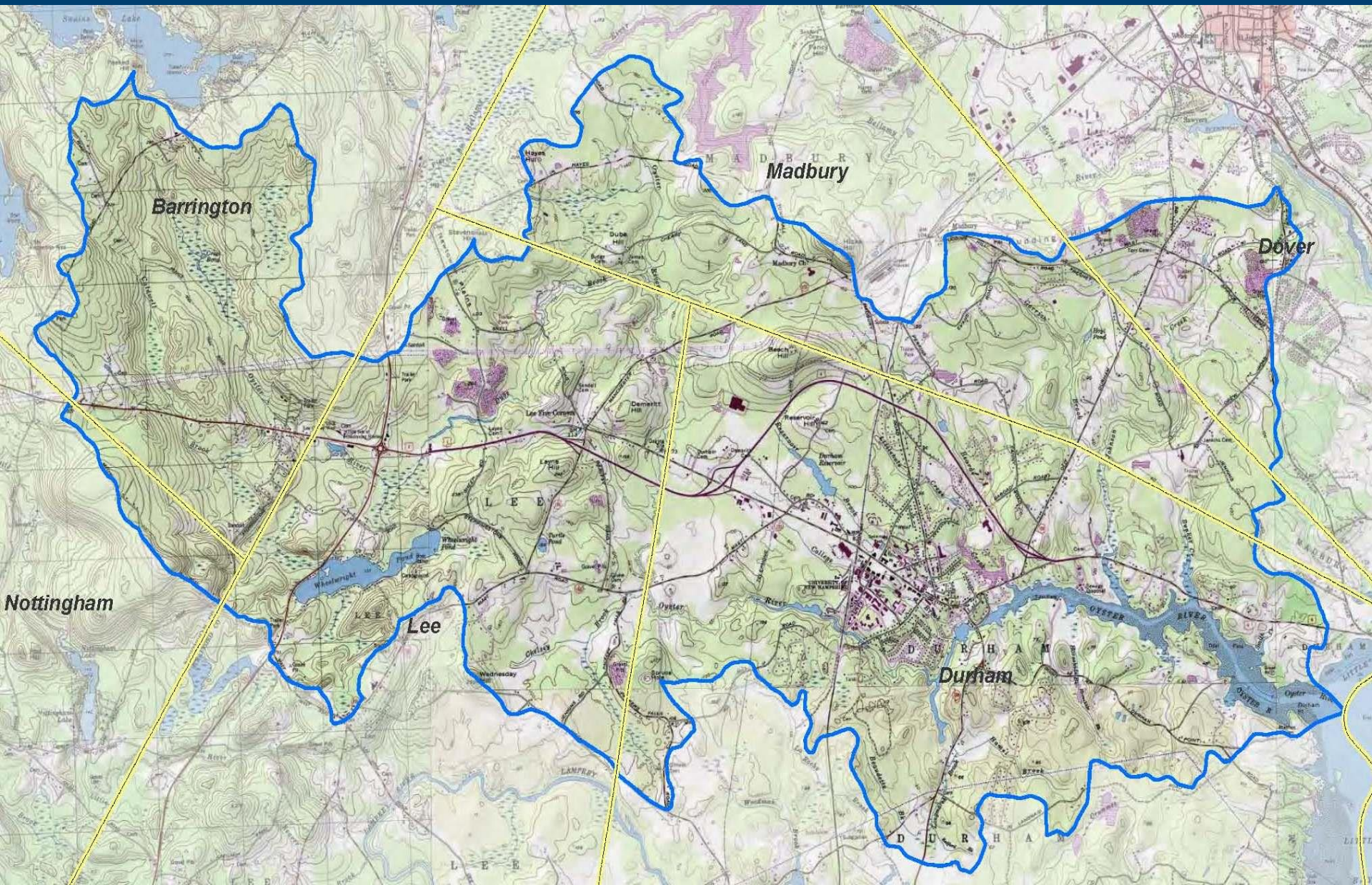
Historical Population and IC Growth in OR Watershed (1990-2010)



IC Area per capita: 800 to 1,400 sf in 20 yrs

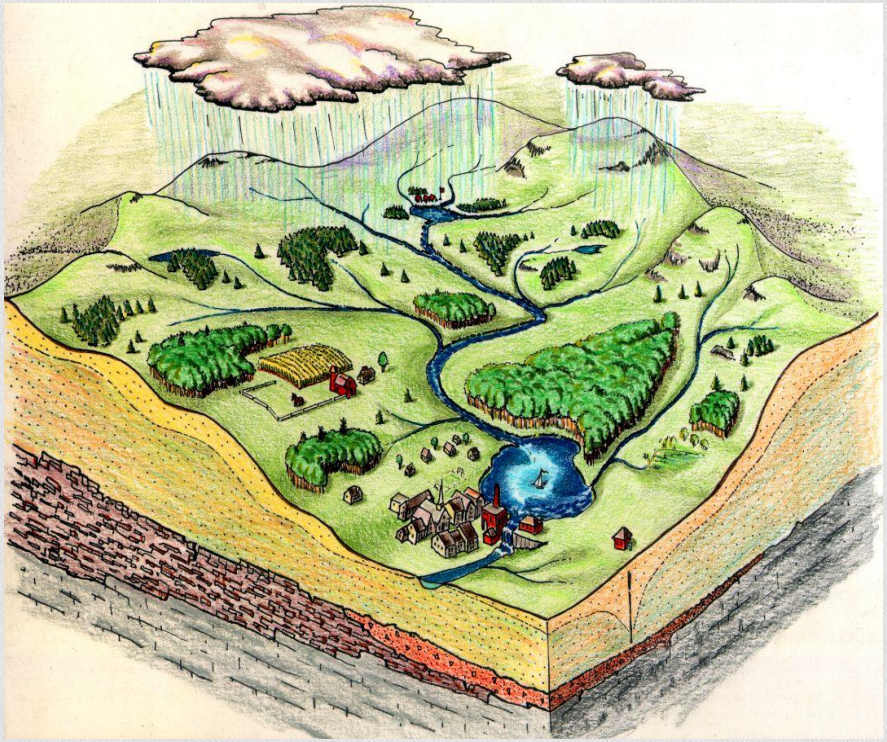
Watershed Modeling of NPS Nitrogen Loads

Oyster River Watershed



Nonpoint Sources & Land Uses

- Impervious Cover
- Lawn Fertilizer
- Agriculture Fertilizer
- Septic Systems
- UNH Manure Application
- Pet Waste



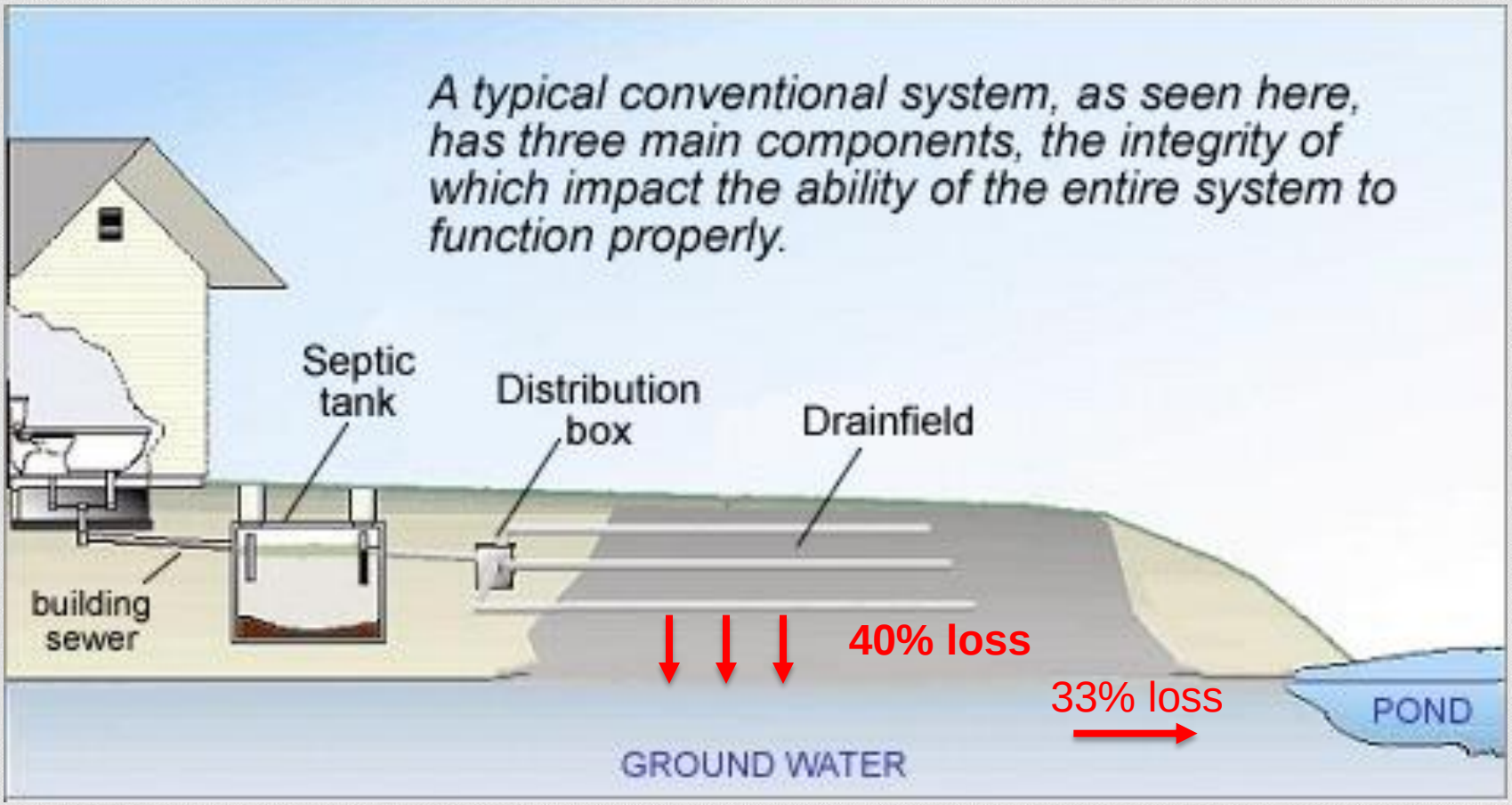
Data Input for Land Use / Sources

- Impervious Cover:
  - 2010 High Resolution Imagery for Durham (1 meter pixel)
  - UNH Campus GIS Mapping Data
  - Storm Drain System Mapping to determine DCIA and DIA
- Lawn Area
  - Used LiDAR to exclude Tree Canopy and Imp. Cover
  - Conducted Resident Survey to Estimate Fertilizer Usage
- Septic Systems
  - Used Aerial Imagery to Determine Building Counts /Locations
- UNH Manure Application Rate and Locations

Key Model Data Inputs

Source	Load Rate
Atmosphere	5.2 lbs/ ac
Septic	10.6 lbs / person /yr
Cows	198 lbs / cow
Horses	88 lbs / horse
Dogs	1.1 lbs / dog
Agriculture	25 - 57 lbs / ac
Agriculture – UNH manure	80 - 207 lbs / ac

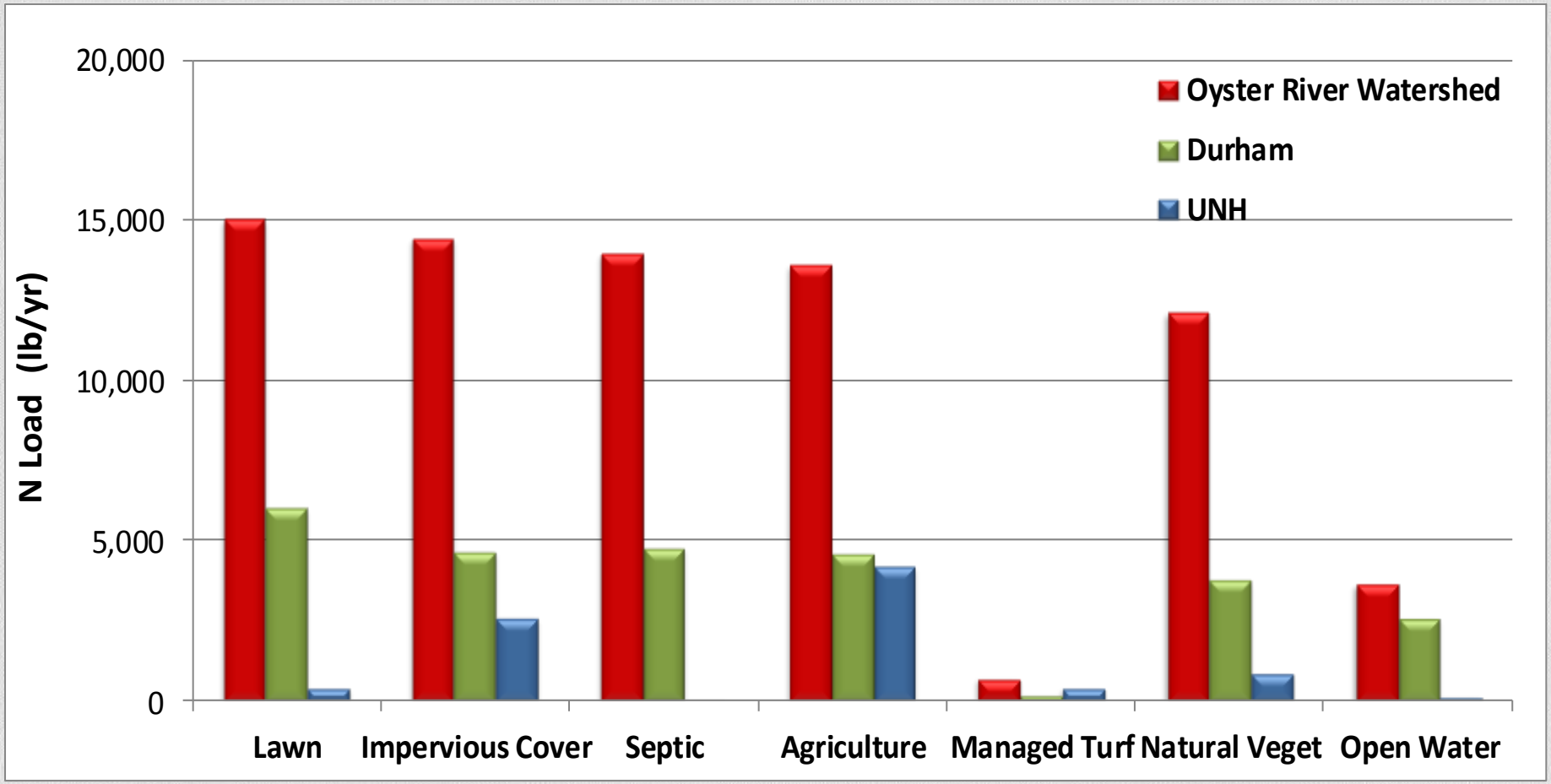
Assumptions on Septic System N Losses



Total Delivery either 60% or 26%

Delivered load of 6.4 lbs to 2.8 lbs/person/yr

Model Estimates of NPS N Loads

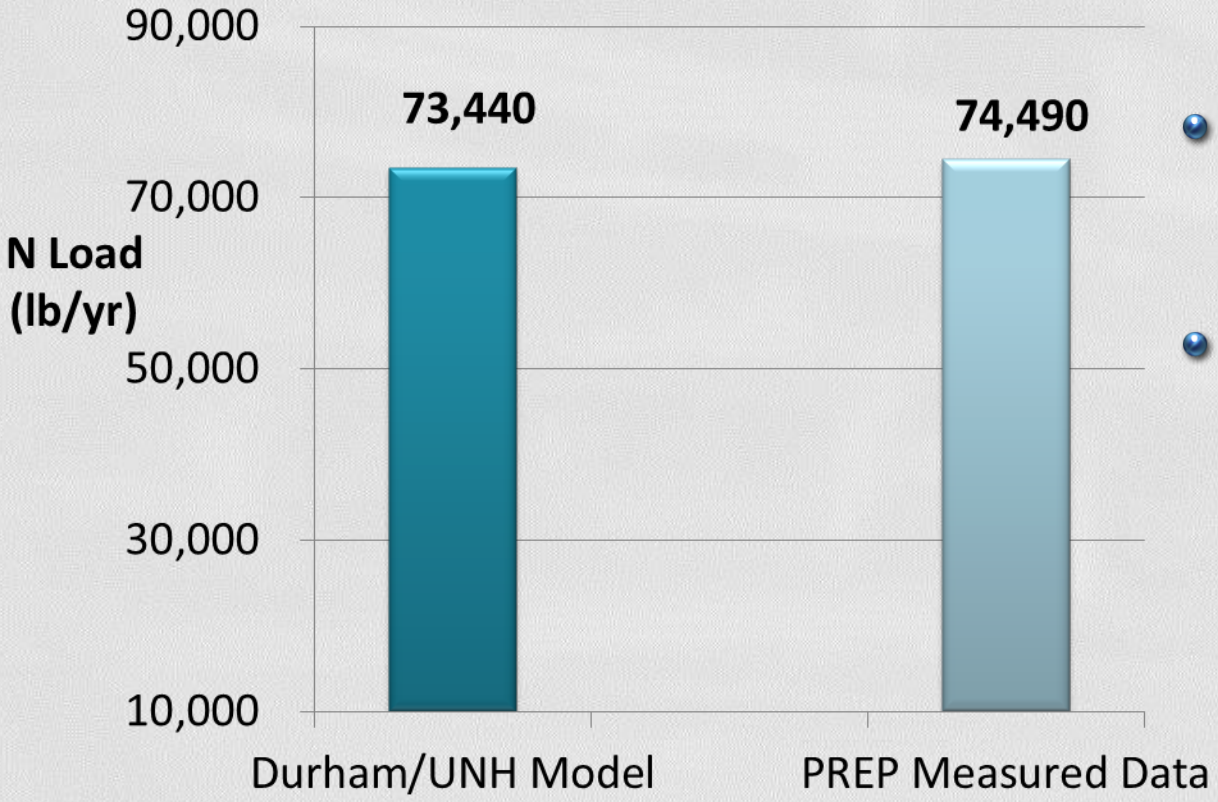


Estimated NPS N Loads for Oyster River Watershed

Land use/ Source Input	Load (lbs/yr)	Load (%)	Area(ac) or Count	Area (%)
Lawn	15,020	20%	1,470	7%
Impervious Cover	14,420	20%	1,540	8%
Septic	13,950	19%	5,350*	na
Agriculture	13,590	19%	1,570	8%
Managed Turf	710	1%	30	0.2%
Natural Vegetation	12,100	16%	14,300	73%
Open Water	3,640	5%	740	4%
Total	73,440		19,660	

Notes: * = no of people on septic systems

Comparison of Model vs. Measured Load



- Median TDN Conc. = 0.41 mg/L
- Monthly Sampling at Mill Pond Dam between 2008-2011; 43 samples.
- TN /TDN Ratio of 1.20 based on Lamprey R Data: TN = 0.49 mg/L

Comparison to Measured Data

Watershed	Estimated % Forested Cover	Estimated % Impervious	Source Load (lbs/ac/yr)	Delivered Load (lbs/ac/yr)	Percent Delivered
Oyster River NLM	76 %	8%	14.9	3.9	26%
Lamprey River	80 %	< 5%	11.8	2.2	19%
Wednesday Hill Brook	60 %	12 - 15 %	17.8	4.3	24%
Moonlight Brook	< 50 %	30 - 40 %	12.5	5.0	40%

Notes: [1]Data for these two watersheds was based on data presented by Dr. Wiliam McDowell, PhD at the Nitrogen Loading Workshop held May 11, 2013 at the DES-Pease office. [2]This watershed is primarily sewered, which may explain relatively lower source load input value.

NPS Management Measures

Durham/UNH Draft Watershed Mgt and Implementation Plan

Targeted Management Measures

- Agricultural Nutrient Management Plans
- Promote Best Fertilizer Practices via Public Outreach
- Septic Management and Targeted Cost-Share for Advanced Treatment
- Stormwater BMP Retrofit and Redevelopment
- Oyster Bed Restoration

Possible Management Scenarios:
(Durham/UNH Sources only)

Management Alternative	Estimated Load Reduction	
	(lbs)	(tons)
Durham Lawn Fertilizer Best Practice Outreach (15% Reduction)	-1,000	-0.5
Enhanced Nutrient Management for UNH Ag (18% Reduction)	-700	-0.4
Retrofit/Redevelop Impervious Area (~6 to 8 ac/yr)	-400	-0.2
Increase Septic System Maintenance through Outreach and Targeted Upgrades (4 to 6 systems/yr)	-200	-0.1
Oyster Restoration (2 acres)	-1,600	-0.8
Totals	**~3,900**	**~2.0**

*Future phases can be expanded to focus on other watershed areas aside from Durham and UNH.

Fertilizer Management for entire Watershed alone = apprix 1.8 ton reduction

Durham – NPS Management Costs

NPS Management	Estimated Annual Load Reduction (lbs TN/year)	Annual and Recurring Cost[1] (O&M)	Capital and Startup Cost[2]	Estimated Total Annual Cost	Total Cost per Pound of Nitrogen Removed[4]
Lawn Fertilizer Outreach Program	1,050	$50,000	$110,000	$60,000	$50
Agric. Nutrient Management	736	$60,000	$310,000	$80,000	$110
Impervious Cover Retrofitting	370	$35,000	$850,000	$100,000	$260
Septic System Outreach / Grants	220	$80,000	$85,000	$95,000	$390
Oyster Bed Restoration	1,600	$3,000	$270,000	$22,000	$15

[1] Annual operations and maintenance costs include O&M activities, estimated staff time for annual program administration, and/or other recurring annual costs.
[2] Capital/Startup costs include startup implementation cost associated with contracted services, equipment purchases, and/or design and construction of structural measures.
[3] Annualized costs convert capital cost annualized over 20 years at 3.5 percent interest.
[4] Cost per pound removed is calculated as total annual cost based on 20 year repayment period divided by the estimated annual load reduction after implementation.

Prelim. Cost Estimate for NPS Prgrm

NPS Program	Estimated Annual Load Reduction after 5 years[1] (lbs N/yr)	Approx. Total Annual Cost
"Bay Friendly" Lawn Fertilizer Program (15 % reduction)	1,000	$ 60,000
UNH Agriculture Nutrient Management (15% reduction)	700	$80,000
Impervious Cover Mgt. Program (4-6 BMPs /yr over 5 yrs)	400	$100,000
Septic System Program	200	$90,000
Oyster Bed Restoration (2 ac at 800 lbs N/ac)	1,600	$22,000
Total	**3,900**	**$ 352,000**

Notes: 1 Expected load reduction after 5 years; Annual costs include staff and reoccurring costs, while capital costs are expected one-time equipment or construction – annualized costs represent Present Value amortized over 20 year period at a 3.5% interest rate

Estimated Cost for WWTF Upgrade to 3 mg/L

Effluent Limit	Annual (O&M) Cost[1]	Capital Cost[1]	Annualized Capital Cost	Total Annual Costs
5 mg/L	$ 360,000	$ 8.7 M	$ 610,000	$970,000
3 mg/L	$ 690,000	$ 13.4 M	$ 950,000	$1,640,000
Difference	$ 330,000	$ 4.7 M	$ 330,700	$ 670,000

Based on 2012 DRAFT Durham WWTF Facilities Plan prepared by Wright-Pierce

Permitting Hurdles

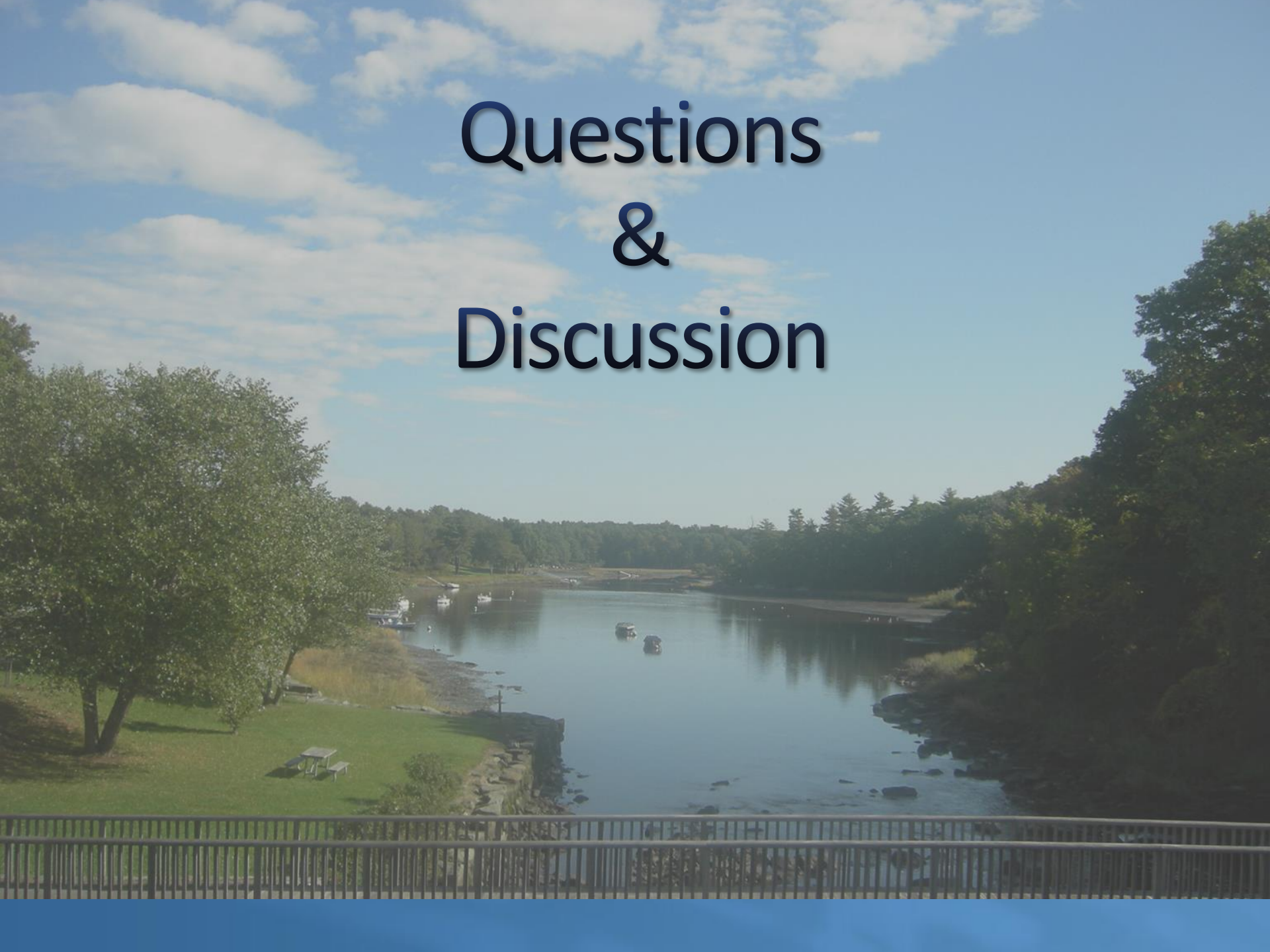
- EPA not comfortable with WQ trading to offset WWTF treatment using NPS
- EPA believes CWA requires them to impose LOT (3 mg/L) in NPDES Permit
- Delayed Issuance of MS4 Permit

Drawbacks of Conventional Permitting

- Limited Incentive to Address Nonpoint Sources
- Missed Opportunities for Cost Savings
- Water Quality Benefits Limited to One Portion of the Water Body
- Limited Incentive for Innovation
- Less Stakeholder Collaboration (No Multiplier Effect from other Stakeholders Participating)

Positive Spin Offs of Durham - UNH Study

- NPS Control Framework with Estimated Costs
- Advanced and Enhanced WQ Monitoring Tools
- Increased Awareness of NPS Sources/Controls
  - Stormwater BMP Implementation
  - Review of Local Regulations
  - UNH SC Study on the Effects of Local Regulations on Reducing Loads from Future Development
- Innovation
  - Pilot Pollutant Tracking and Accounting Program
  - Advancing the Concepts of Urine Diversion


Questions
&
Discussion

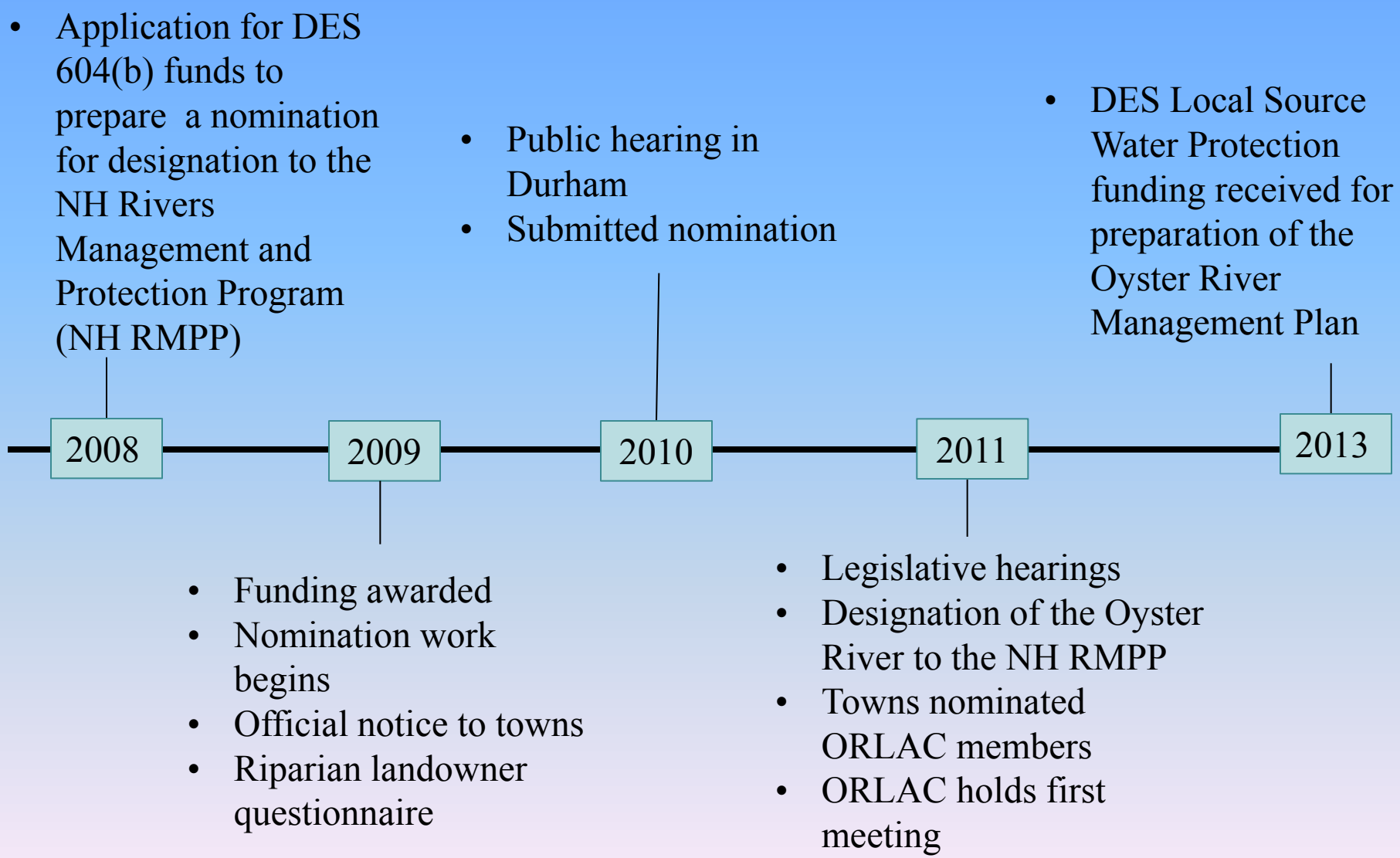
Development of the Oyster River Corridor Management Plan

Kyle Pimental, Senior Regional Planner
Stafford Regional Planning Commission
Drinking Water Source Protection Conference
May 6, 2015

Outline

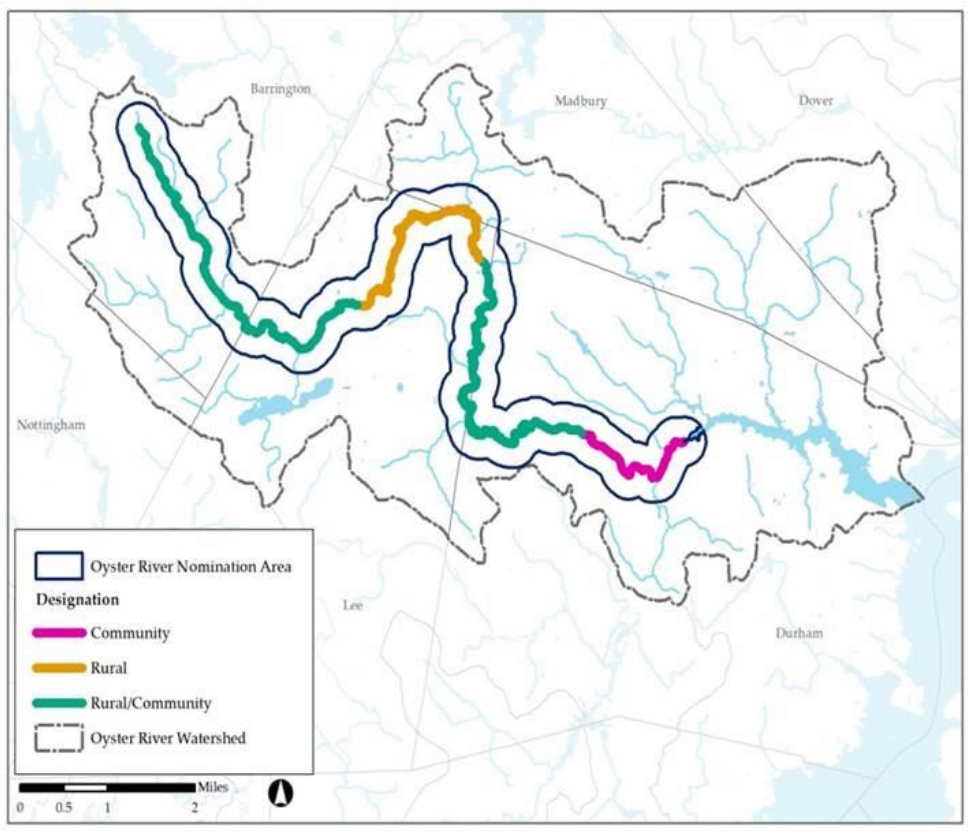
- River Nomination
- Corridor Management Plan Process
- Coordination with VHB
- Specific recommendations for nitrogen reductions
- Next steps for implementation

Oyster River's State Designation



Corridor Management Plan Process

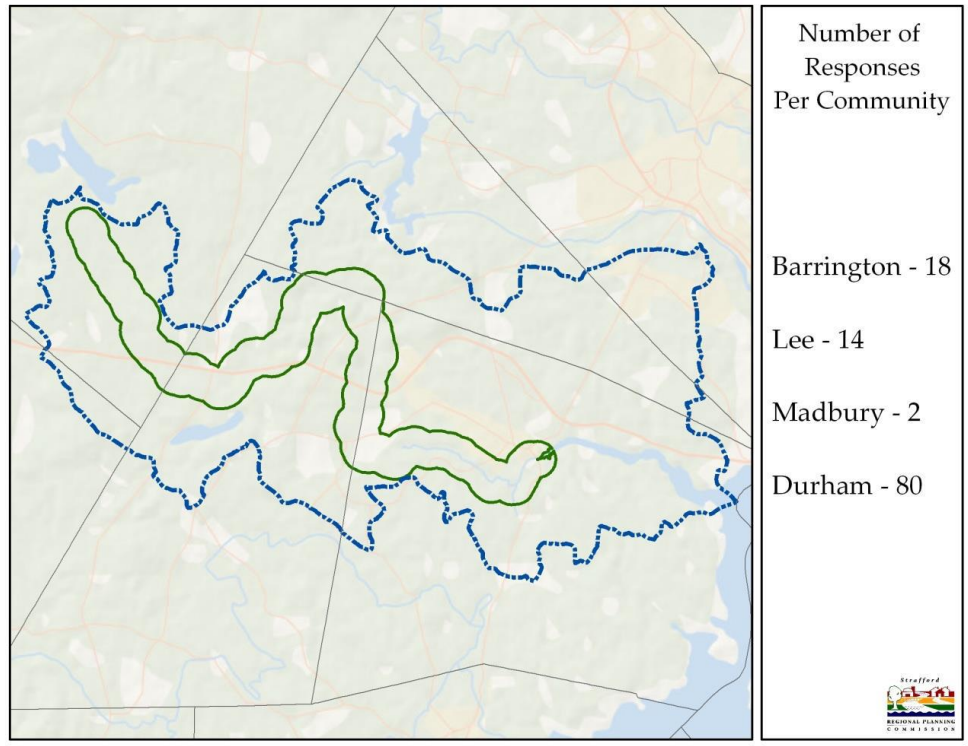
- Information Gathering
- Plan Development
- Introduction of the Plan to communities



Information Gathering

- Property owner survey
- Municipal officials survey

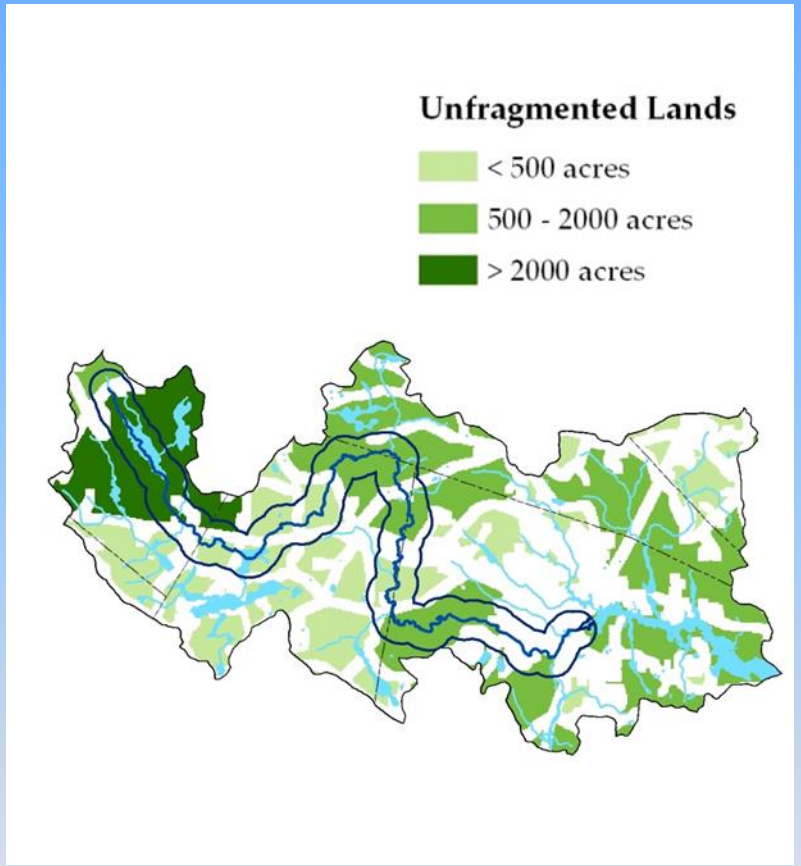
22% return rate



- Survey was developed to track changes in land use and property owner concerns from prior surveys completed in 2001 and 2009.

Information Gathering

- Conservation Commission meetings
  - Madbury: Jan. 27, 2014
  - Lee: Feb. 3, 2014
  - Barrington: Feb. 6, 2014
  - Durham: Feb. 18, 2014



Information Gathering

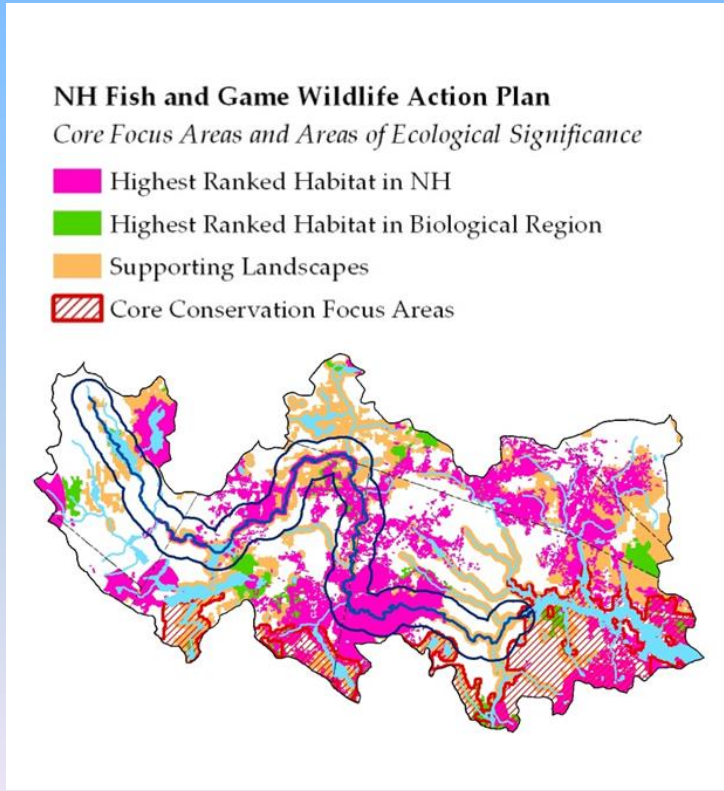
- Key focus interviews:
  - Oyster River Watershed Alliance
  - Oyster River Local Advisory Committee
  - Local developer
  - UNH Stormwater Center
  - UNH professor
  - Lee Conservation Commission
  - Former land use lawyer
- Questions:
  - What are your biggest concerns in regard to the current and future health of the river?
  - What types of management strategies would you like to see the local advisory committee address that would be most helpful in your community?
  - How would you like to see the issue of nitrogen discharging into the Great Bay addressed in this corridor management plan?
  - What are your thoughts on current local regulations along the Oyster River?

Key Results from Survey and Outreach

- Water quality is of high importance
- There are significant concerns of water pollution and development too close to the river
- More nitrogen loading information is needed
- Local regulations are adequate, but are not always enforced
- Stormwater runoff is a major concern
- Public education and outreach to reduce nitrogen levels and lower costs
  - Septic system, lawn care, agriculture best management practices, and pet waste

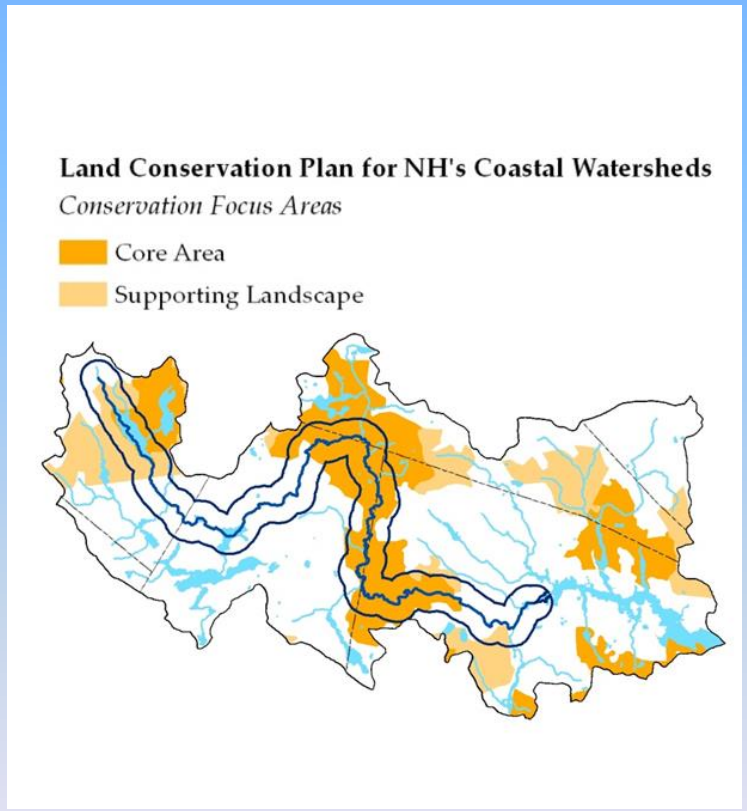
Plan Development

- Strafford Regional Planning Commission tasked with preparing draft plan with guidance from the Oyster River Local Advisory Committee
- Input from NHDES
- ORLAC review
- Public review process
- Completion of final plan in 2014



Introduction of Plan

- A public meeting for watershed communities was organized
- Press release through the NHDES blog and newsletter
- SRPC press release
- Posting on websites
  - SRPC, ORLAC, NHDES



Coordination with VHB

- Oyster River Integrated Watershed Plan for Nitrogen Load Reductions
  - Sharing sampling data and information on how precipitation events influence nitrogen concentrations and loads
- Recommended strategies and preliminary cost estimates for a possible nitrogen control program
- Data and strategies from the report were reviewed by SRPC and ORLAC during the development of the corridor management plan

Recommendations for Nitrogen Reductions

- Strategies to reduce nitrogen loading:
  - Lawn fertilizer program
  - Agriculture management
  - Impervious cover
  - Existing septic system
  - Oyster bed restoration

- Priority management issues in the river corridor
  - Water Quality and Quantity Protection
  - Stewardship, Education, and Outreach

[Image Credit: Ben Kimball]

Goals for Nitrogen Reduction in Plan

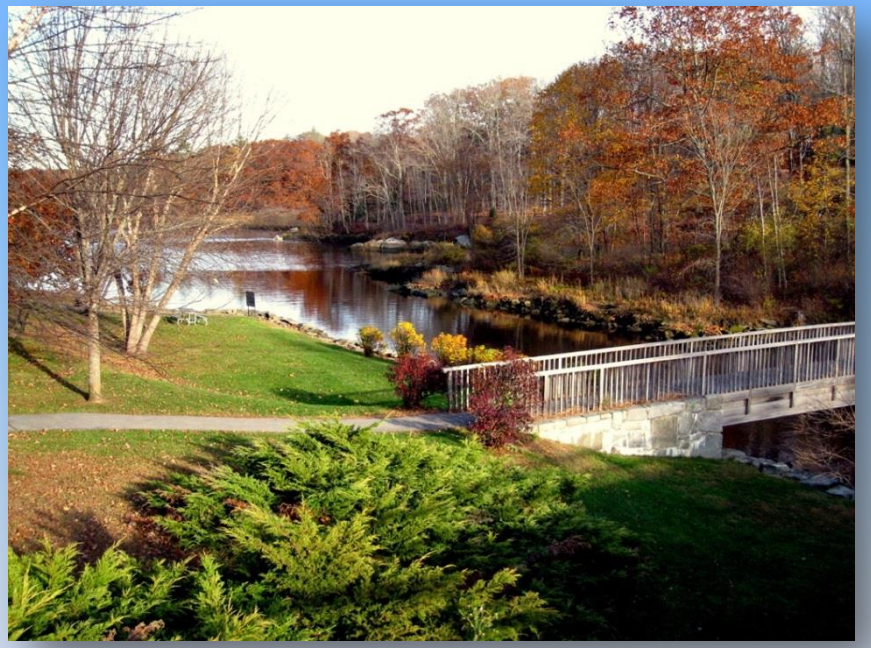
- Protect and restore riparian buffers
  - Identify watershed-wide goals for fertilizer setback application
  - Encourage land protection and habitat conservation
  - Identify highly visible locations for demonstration projects (schools/park) that model best management practices for landscaping
- Raise awareness of non-point source pollution
  - Support the development of ordinances that limit the use of fertilizers that contain nitrogen and/or phosphorus in the watershed
  - Encourage adoption of 100ft protective standard for fertilizer and septic systems
  - Create factsheet that summarizes findings and recommendations of the Oyster River Integrated Watershed Plan
  - Conduct public outreach on the impact of lawn care fertilizers, leaking septic systems, and stormwater treatment
  - Collaborate with UNH to identify strategies to reduce non-point pollution from agriculture

Goals for Nitrogen Reduction in Plan

- Limit water runoff and nutrient transport
  - Support a multi-faceted approach to reducing nitrogen that includes controls at wastewater treatment facilities, identification of failing pipes, septic systems, etc.
  - Development of ordinances that regulate the spreading of sludge on agriculture fields, and source control through stormwater management
  - Support site plan regulations that require low-impact development
  - Collaborate with UNH Stormwater Center and Cooperative Extension to provide outreach to homeowners
    - Rain gardens, rain barrels, and reducing impervious surface
- Monitor and identify hazards
  - Identify sensitive areas that require targeted monitoring due to their vulnerability to current and potential hazards including nitrogen, phosphorus, road salt, stormwater, and impervious surface

Next Steps for Implementation

- Oyster River Local Advisory Committee to meet with the four corridor communities:
  - Prioritize action items
  - Identify potential partnerships
  - Seek funding opportunities
  - Apply for funding to implement goals and recommendations



Thank You.

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Strafford
REGIONAL PLANNING
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